

**(PCT Article 36 and Rule 70)**

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/JP	Authorized officer
Facsimile No.	Telephone No.

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP2004/013158

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_ which is the language of a translation furnished for the purposes of:
- ☐ international search (Rule 12.3 and 23.1(b))
- ☐ publication of the international application (Rule 12.4)
- ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-2, 4, 7-10, 12, 14-40 as originally filed/furnished
- pages\* 3, 5, 6, 6/1, 11, 13 received by this Authority on 04.06.2005
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- nos. 2-12, 14-22, 24-28 as originally filed/furnished
- nos.\* \_\_\_\_\_ as amended (together with any statement) under Article 19
- nos.\* 1, 13, 23 received by this Authority on 04.06.2005
- nos.\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- sheets 1-15 as originally filed/furnished
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

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## Box No. IV Lack of unity of invention

1. ☐ In response to the invitation to restrict or pay additional fees the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted the claims nor paid additional fees.
2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:
- ☐ complied with.
  - ☒ not complied with for the following reasons:

Claim 1 can be considered to set forth an invention that is characterized by the feature wherein an infrared sensor configured from an InSb based compound semiconductor is packaged in a hybrid configuration, whereas claims 13 and 23 can be considered to set forth inventions that are characterized by the layered structure of the infrared sensor that is configured from an InSb based compound semiconductor.

Such being the case, claims 1 to 12 and claims 13 to 28 do not share a common feature that can be considered to be a special technical feature in the meaning of PCT Rule 13.2.

4. Consequently, this report has been established in respect of the following parts of the international application:

- ☐ all parts.
- ☐ the parts relating to claims Nos. \_\_\_\_\_

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**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	1-28	YES
	Claims		NO
Inventive step (IS)	Claims	13-28	YES
	Claims	1-12	NO
Industrial applicability (IA)	Claims	1-28	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

Document 1: WO 96/05621 A (SRI INTERNATIONAL)

Document 2: K. YAMAMOTO et al., "Development of a JFET amplified InSb infrared detector array for use at liquid helium temperature," SPIE, Vol. 1157, Infrared Technology XV (1989), pages 338 to 349

Document 3: E. MICHEL et al., "Sb-based infrared materials and photodetectors for the 3-5 and 8-12  $\mu\text{m}$  range," The International Society for Optical Engineering, Proceedings of SPIE Vol. 2685, Photodetectors: Materials and Devices, April 1996, pages 101 to 111

Document 4: JP 62-257773 A (Toshiba Corp.)

Document 5: JP 6-196745 A (NEC Corp.)

Document 6: US 5455421 A (Spears)

Document 7: Shinpan Denki Kogaku Handbook, Shadan Hojin Denki Gakkai, pub. Showa 63 Nen (1988), Kiso Bumon Vol. 8: Denshi Device, Chapter 9: Hybrid IC, pages 376 to 378

(1) Document 1 indicates that in the past, InSb based materials and the like were used to configure infrared ray detection devices. Therein, document 1 also discloses

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various features, including the feature wherein infrared ray detection devices are produced by means of a monolithic integration technique whereby an InSn based compound or the like is provided upon a GaAs substrate and then an integrated circuit is mounted upon the same chip (pages 1 to 2).

Consequently, the invention that is set forth in claim 1, wherein the compound infrared ray sensor unit and the integrated circuit unit are arranged in a hybrid layout, is different from the invention that is disclosed in document 1, wherein the compound infrared ray sensor unit and the integrated circuit unit are mounted in a monolithic manner.

However, given the content of the disclosures in document 7 (...make a comparison of hybrid integrated circuits, which are also referred to as mixed integrated circuits, and monolithic integrated circuits (semiconductor integrated circuits) wherein the circuit has been formed within the silicon chip. ... Hybrid integrated circuits and monolithic integrated circuits have slightly different characteristics, and are generally serve complementary roles. For example, hybrid integrated circuits are often used in the initial stages of the development of a new products such a electronic devices, and are also commonly used in power source circuits, output circuits, electric motor drive circuits, sensor circuits and the like."), both monolithic configurations and hybrid configurations can be considered to have been well known as techniques for integrating an infrared ray sensor unit and an integrated circuit unit at the time the present application was filed. Such being the case, it would have been obvious to

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a person skilled in the art that it is possible to select either configuration according to the degree of integration of the elements, the size of the package and the like.

As a result, claim 1 cannot be considered to involve an inventive step in the light of document 1.

(2) The inventions set forth in claims 2 to 12 differ from the invention that is disclosed in document 1 in that document 1 does not make any specific disclosures with regards to the structure of the InSb infrared ray sensor.

However, documents 3 to 6 all disclose InSn infrared ray sensors, and document 3 discloses the feature of employing a p-i-n structure or a heterostructure and the feature of using Sn or Zn as the n-type dopant or the p-type dopant; document 4 discloses the feature of providing a buffer layer of InAsSb or the like and the feature of employing a pn structure; document 5 discloses the feature of employing an AlGaSb/InAs superlattice structure and the feature of providing a GaSb buffer layer; and document 6 discloses a pn structure, a transverse diode, a superlattice structure and the like.

Such being the case, claims 2 to 12 cannot be considered to involve an inventive step in the light of documents 1 and 3 to 6.

(3) Claims 13 and 23 can be considered to set forth inventions wherein the band gaps of the sixth through eighth compound semiconductor layers are delimited in the manner that is presented therein in order to decrease the

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element resistance of the sensor by increasing the electron mobility of the sixth compound semiconductor layer and in order to suppress the diffusion current in the sensor by means of the eighth compound semiconductor layer. On the other hand, documents 1 to 7 do not disclose the inventions in question.

Such being the case, claims 13 to 28 can be considered to involve an inventive step in relation to the abovementioned documents.